Integrating culturally responsive place-based content with language skills development for curriculum enrichment

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The contents of this program were developed by Sealaska Heritage Institute through the support of a $1,690,100 federal grant from the Alaska Native Education Program.

2012

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Introduction to the Developmental Language Process in Math

OVER THE YEARS, much has been written about the successes and failures of students in schools. There is no end to the solutions offered, particularly for those students who are struggling with academics. For example, there have been efforts to bring local cultures into the classroom, thus providing the students with familiar points of departure for learning.

While the inclusion of Native concepts, values,and traditions into a curriculum provide a valuable foundation for self-identity and cultural pride, they may not, on their own, fully address improved academic achievement.

Through math lessons, students are exposed to new information and to the key vocabulary that represents that information. While the students may acquire, through various processes, the scientific information, the vocabulary is often left at an exposure level and not internalized by the students. Over time, this leads to language delay that impacts negatively on a student's ongoing achievement.

Due to weak language bases, many Native Alaskan high school students struggle with texts that are beyond their comprehension levels and writing assignments that call for language they do not have.

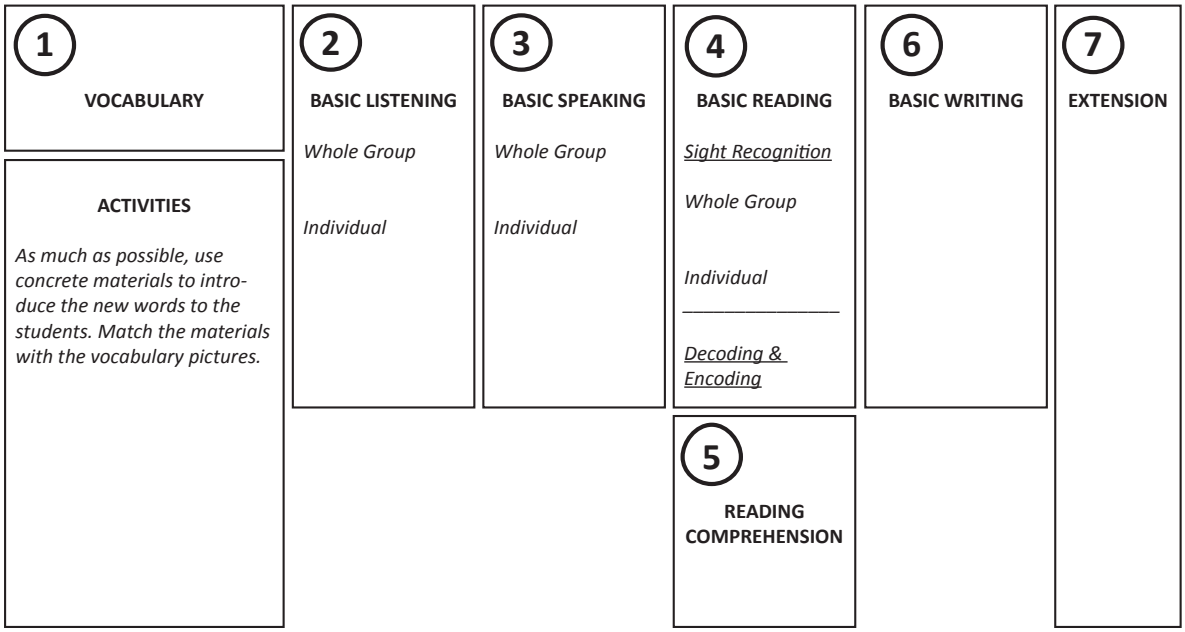
This program is designed to meet the academic realities faced by high school students every day, using a developmental process that integrates culture with skills development.

To this end, each key vocabulary word, in math, is viewed as a concept. The words are introduced concretely, using place-based information and contexts. Whenever possible, the concept is viewed through the Native heritage cultural perspectives. Using this approach, the students have the opportunity to acquire new information in manageable chunks, the sum total of which represent the body of information to be learned in the math program.

When the key vocabulary/concepts have been introduced, the students are then taken through a sequence of listening, speaking, reading, and writing activities designed to instill the vocabulary into their long-term memories.

This is the schema for the Developmental Language Process:

The Developmental Language Process—Math



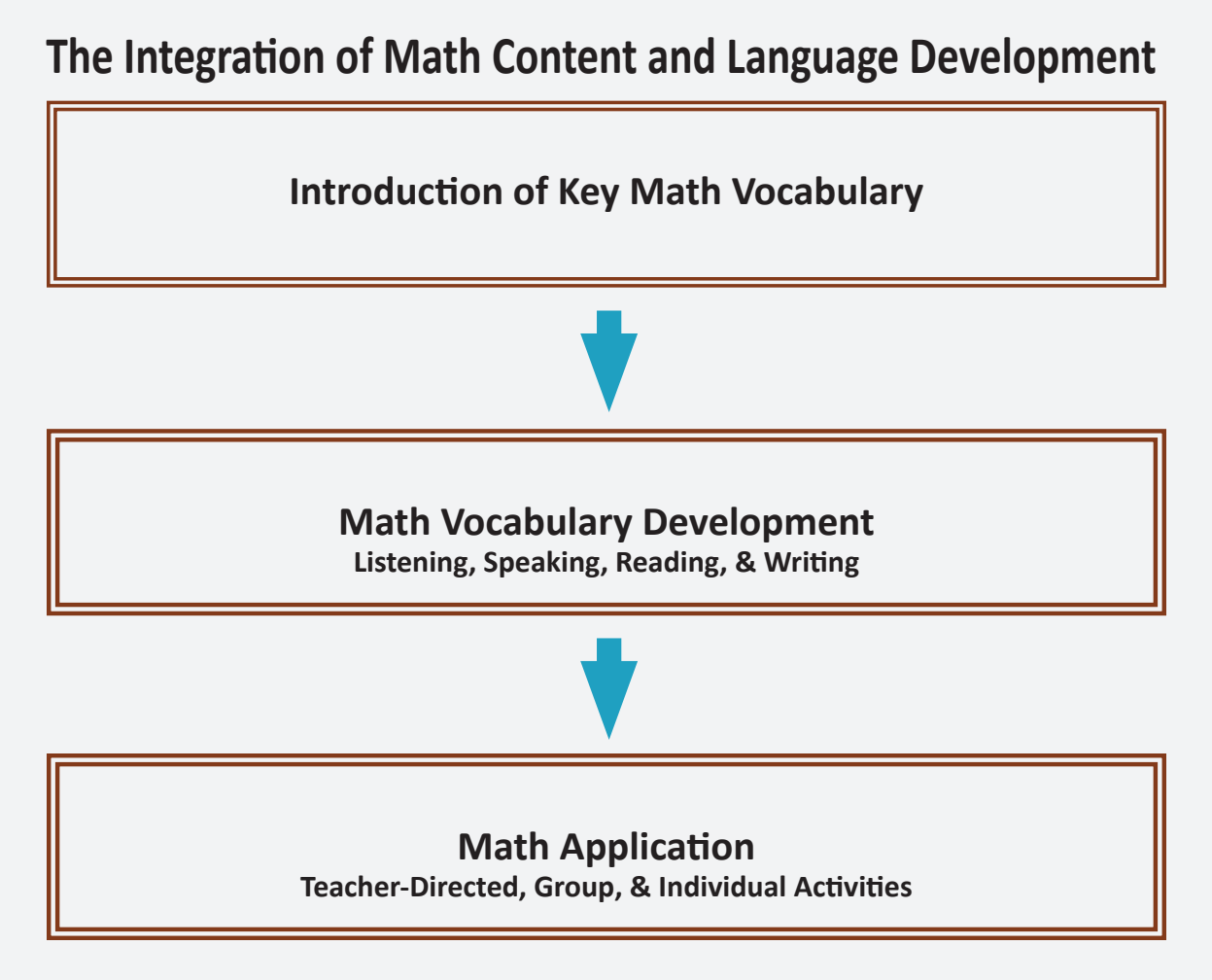
Introduction to the Developmental Language Process in Math

Finally, at the end of each unit, the students will participate in enrichment activities based on recognized and research-based best practices. By this time, the math information and vocabulary will be familiar, adding to the students' feelings of confidence and success. These activities will include place-based and heritage culture perspectives of the information learned.

This approach is radically different from current practices in most math classes. Historically, little or no formal vocabulary development takes place. It is assumed that the vocabulary is being internalized during the learning process, which is most often an erroneous assumption.

Increasing the language bases of the students will lead to improved comprehension in listening and reading, and higher levels of production in creative speaking and writing.

This, coupled with the place-based and culturally-responsive content, will provide the students with the foundations necessary for ongoing confidence and achievement.



Sealaska Heritage Institute 4

UNIT 1: Numeration
Understanding Numbers

Note: All key terms are based on the Math Standards for Alaska and reflect terms vital to academic achievement in math.

INTRODUCTION OF MATH VOCABULARY

Process Skills

Concrete Introduction of Key Vocabulary
Note: *A vocabulary graphic is provided in this unit for each of the key words. Definitions for all of the key words can be found in the glossary at the back of this program.*

REAL NUMBER

Have the students line up in a row and call out numbers sequentially starting at a negative number and ending on a positive in ascending order. Explain that the row represents a number line of real numbers and tht any number along it can be represented as a fraction.

WHOLE NUMBER

Show the students a box of cereal. Explain that while there are many parts to the box and its contents, the box itself makes up a whole single unit. Whole numbers too are integers representing a number that does not contain a fraction. They are zero or positive!

SCIENTIFIC NOTATION

Ask the students how many stars they believe exist in the universe (recent estimates are 300 sextillian). Have them write the highest number that they come up with on the board. Explain that large numbers are hard to work with and take up a lot of space. For this reason scientific notation gives us shorter representations of these gigantic numbers!

Process Skills

Concrete Introduction of Key Vocabulary
Note: *A vocabulary graphic is provided in this unit for each of the key words. Definitions for all of the key words can be found in the glossary at the back of this program.*

STANDARD

Go around the room and ask each student to state his or her shoe size. Now explain that shoe sizes are different from country to country and that this can make things very confusing when traveling! A "standard form" can help to make life easier and more consistent. In math, an equation for a line, Ax+By=C, helps everyone to be able to interpret the equation the same way!

EXPANDED NOTATION

Ask for a volunteer to write his or her name on the board. Explain that the name represents the whole person but that there are many things that make up the student (clothes, physical attributes, personality etc). Have the students list these, then explain that this is the expanded version of the volunteer. Numbers can be expanded too to show their components!

RATIONAL NUMBER

Ask the students how many times they have been fishing in their lives. Explain that these numbers are rational and can be represented as fractions. They can be negative too! We might jokingly think of fishing trips where nothing was caught as being negative!

Process Skills

Concrete Introduction of Key Vocabulary
Note: *A vocabulary graphic is provided in this unit for each of the key words. Definitions for all of the key words can be found in the glossary at the back of this program.*

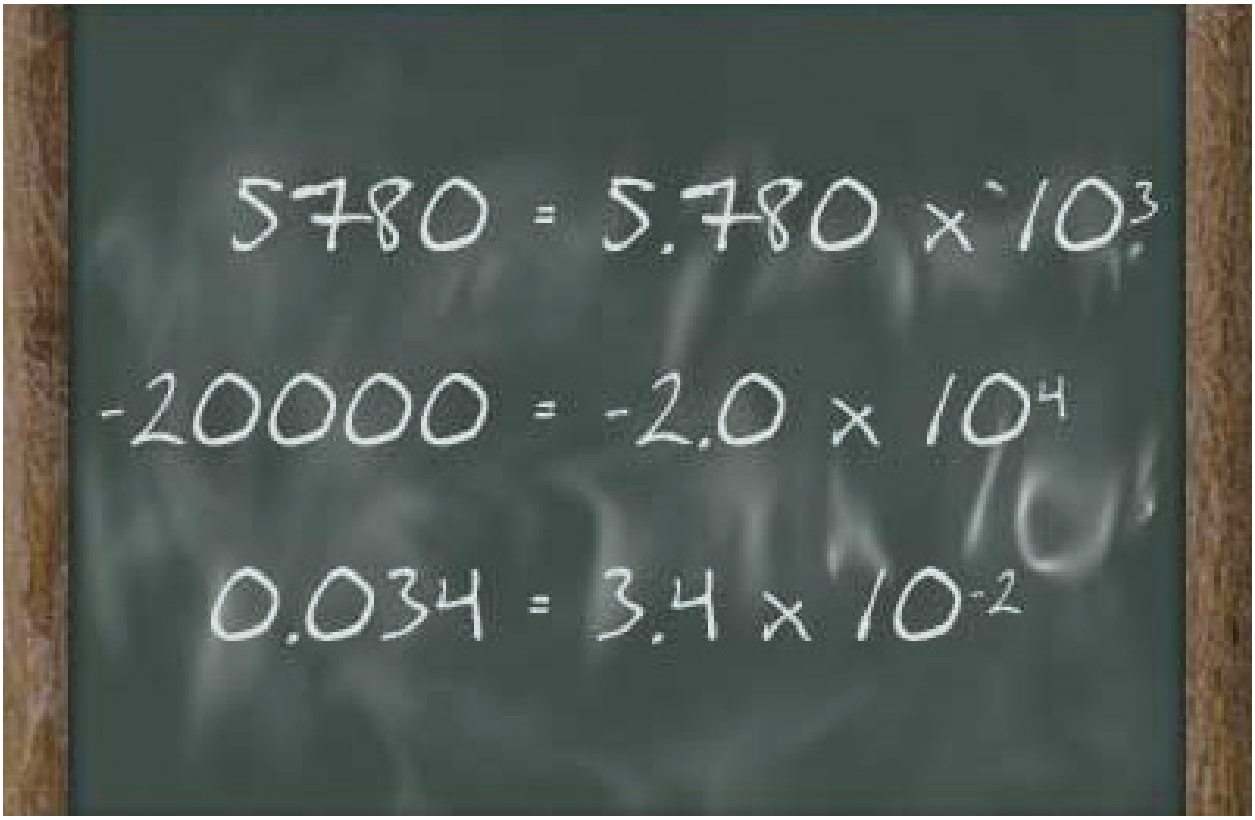
INTEGER

Pass out several goldfish crackers to the students. Have them make two lists, one with how many crackers are left and one with how many were eaten. Tell them to eat them one at a time or two at a time but not in parts. Explain that these negative and positive whole numbers are integers. Enjoy!

VOCABULARY PICTURES

REAL NUMBER

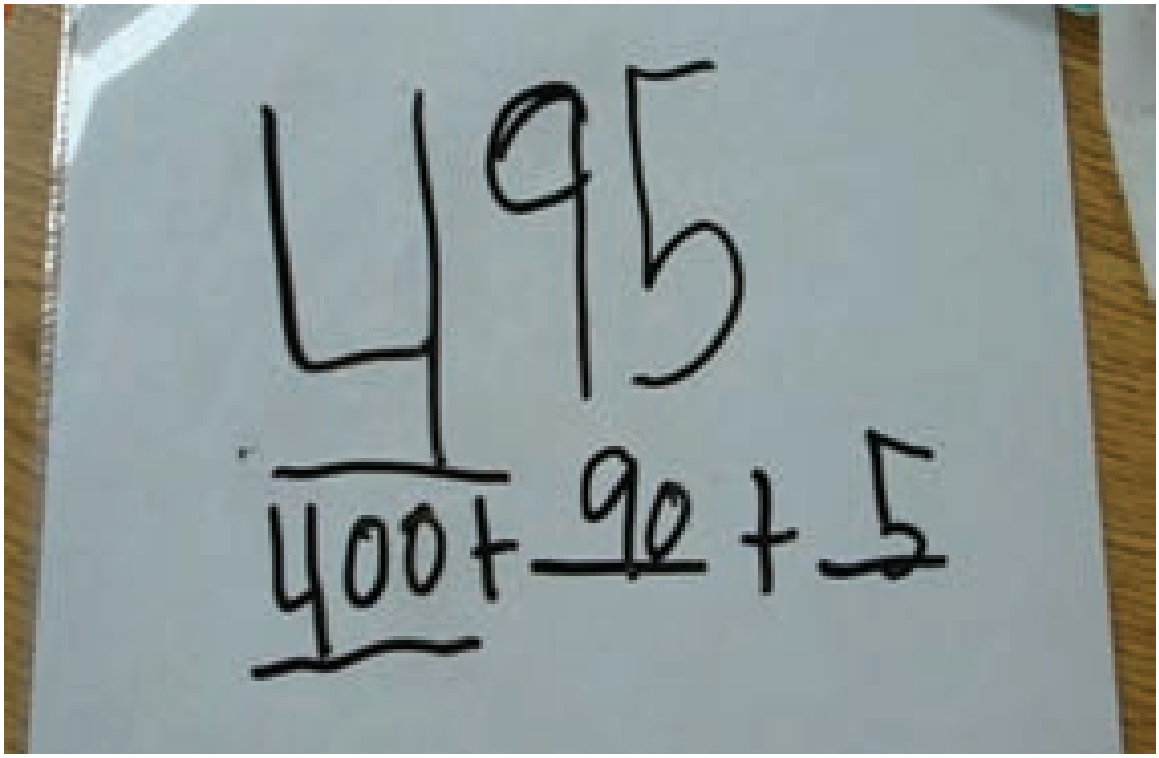
WHOLE NUMBER


5780 = 5.780 x 10^3
-20000 = -2.0 x 10^4
0.034 = 3.4 x 10^-2

SCIENTIFIC NOTATION

Ax + By = C

STANDARD FORM


495
400 + 90 + 5

EXPANDED NOTATION

1/4
1/2

RATIONAL NUMBER

35

INTEGER

LANGUAGE ACTIVITIES

Language and Skills Development

LISTENING

Review the key math words introduced in this unit. If the vocabulary pictures were not presented during the introduction, show them to the students at this time.

Let's Move

Identify an appropriate body movement for each vocabulary word. This may involve movements of hands, arms, legs, etc. Practice the body movements with the students. When the students are able to perform the body movements well, say a vocabulary word. The students should respond with the appropriate body movement. You may wish to say the vocabulary words in a running story. When a vocabulary word is heard, the students should perform the appropriate body movement. Repeat, until the students have responded to each word a number of times.

Tissue Drop

Group the students in a circle. Stand in the center of the circle with a small piece of tissue paper or an inflated balloon. Give the vocabulary illustration to the students. The students should pass the illustration around the circle in a clockwise direction until you clap your hands. Then, the students should stop passing around the illustration. Toss something like a tissue paper or ball into the center and say a vocabulary word. The student who has the illustration for that word must rush into the circle to catch the object before it hits the floor.

What's the Answer?

Before the activity begins, develop questions related to the concept being studied. For each question, prepare three answers—only one of which in each set is correct for the question asked. Ask the students the question and then read the three answers to them. The students should show you (using their fingers or prepared number cards) which answer is correct for the question asked. Repeat this process with other questions and answers.

Language and Skills Development

SPEAKING

Right or Wrong?

Mount the vocabulary pictures on the board. Point to one of the pictures and say its vocabulary word. The students should repeat the vocabulary word for that picture. However, when you point to a picture and say an incorrect vocabulary word for it, the students should remain silent. Repeat this process until the students have responded a number of times to the different vocabulary pictures.

Hand Tag

Group the students in a circle on the floor. Have the students place their hands on the floor, palms down. Stand in the center of the circle with the vocabulary picture and a flashlight. The object of the activity is to attempt to tag a student's hand or hands with the light of the flashlight. The students must pull their hands from the circle when they think they are about to be tagged. When you eventually tag a student's hand or hands, he/she must then say a complete sentence using the word for a vocabulary picture that you show. Repeat this process until many students have responded.

Language and Skills Development

READING

Introduce the math sight words to the students — match the sight words with the vocabulary graphics. The sight words are included in the Student Support Materials, attached to these lesson plans.

Sight Recognition

Face

Mount the sight words around the classroom on the walls, board, and windows. Group the students into two teams. Give the first player in each team a flashlight. Darken the classroom, if possible. Say one of the sight words. When you say "Go," the students should turn their flashlights on and attempt to locate the sight word you said. The first player to do this correctly wins the round. Repeat until all players in each team have participated.

Sight Word Bingo

Before the activity begins, prepare a page that contains the sight words. Provide each student with a copy of the page. The students should cut out the sight words. When the students have cut out their sight words, each student should lay all of the sight words, but one, face down on his/her desk. Show a vocabulary picture. Any student or students who have the sight word for that picture face-up on their desks should show the sight word to you. Then, those sight words should be placed to the side and other sight words turned over in their place. Continue in this way until a student or students have no sight words left on their desks.

Letter Encode

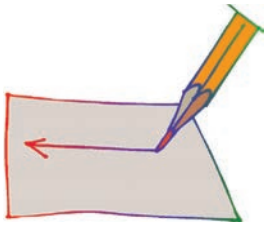
Provide each student with four copies of the Alphabet Page, found on page 72 in the Student Support Materials. The students should cut out their letters and place them in individual envelopes. These cut-out letters will be used throughout the program for letter encode activities. You may wish to have the students write their names on their envelopes. Then, show a picture from this unit. The students must use the cut- out letters to spell the word for the picture. Review the students' work. Repeat, until all of the words have been spelled.

Student Support Materials

Have the students complete the sight recognition and encoding activities in the Student Support Materials. When finished, review their work.

Language and Skills Development

WRITING



Watch Your Half

Prepare a photocopy of each of the vocabulary pictures. Cut the photocopied pictures in half. Keep the picture halves in separate piles. Group the students into two teams. Give all of the picture halves from one pile to the players in Team One. Give the picture halves from the other pile to the players in Team Two. Say a vocabulary word. When you say "Go," the student from each team who has the picture half for the vocabulary word you said should rush to the board and write the word on the board. The first player to do this correctly wins the round. Repeat until all players have participated. This activity may be played more than once by collecting, mixing, and redistributing the picture halves to the two teams.

Sentence Completion

Write a number of sentence halves on individual sentence strips. These should include both the beginning and ending halves of sentences. Mount the sentence halves on the board and number each one. Provide the students with writing paper and pencils/pens. Each student should then complete ONE of the sentence halves in his/her own words, writing his/her part of the sentence on the sheet of paper. When the students have completed their sentence halves, have a student read ONLY the sentence half he/she wrote. The other students must then attempt to identify the "other half" of the sentence on the board (by its number). Repeat until all of the students have shared their sentence halves in this way.

Student Support Materials

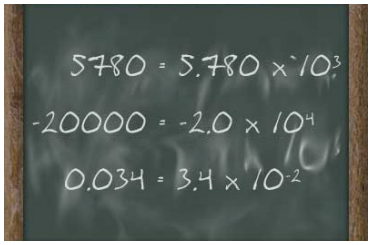
Have the students complete the sight recognition and encoding activities in the Student Support Materials. When finished, review their work.

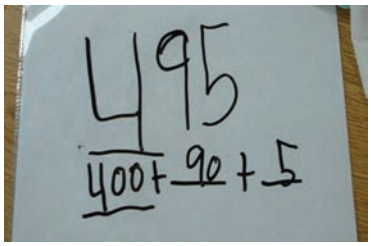
STUDENT SUPPORT MATERIALS

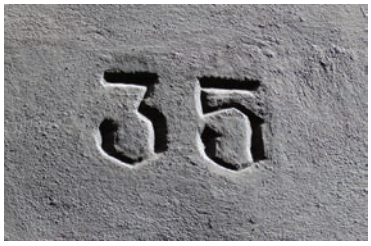
Listening • Mini Pictures

Listening: Mini Pictures

Have the students cut out the pictures. Say the key math words from this unit, and the students should hold up the pictures for them.

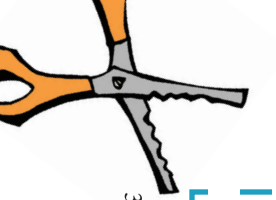






STUDENT SUPPORT MATERIALS

Sight Words



real number

whole number

scientific notation

standard form

expanded notation

rational number

integer

STUDENT SUPPORT MATERIALS

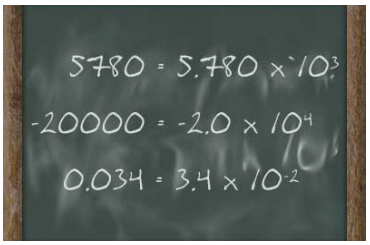
Reading • Sight Recognition

Sight Words Activity Page

Have the students circle the word for each picture.

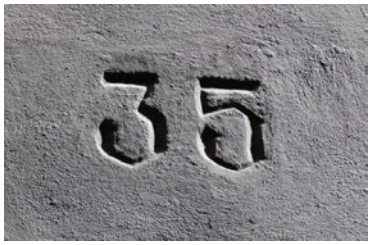
real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

real number
whole number
scientific notation
standard form
expanded notation
rational number
integer



real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

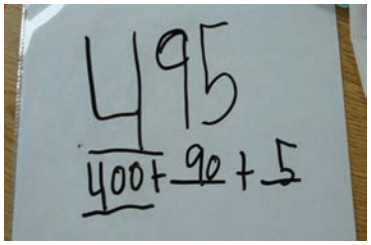
real number
whole number
scientific notation
standard form
expanded notation
rational number
integer



real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

Sight Words Activity Page



real number

whole number

scientific notation

standard form

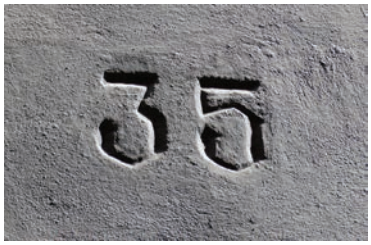
expanded notation

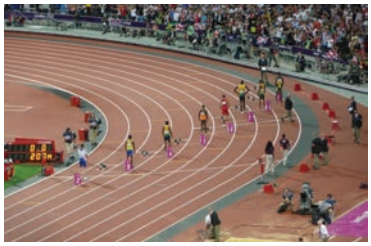
rational number

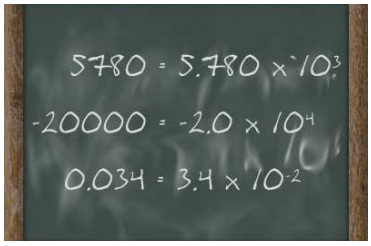
integer

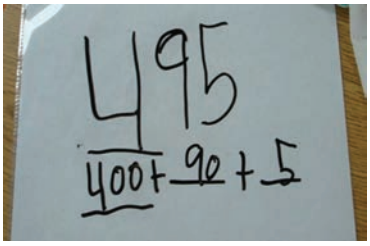
Sight Words Activity Page

Write the numbers on their correct vocabulary graphics.









1. **real number**
2. **whole number**
3. **scientific notation**
4. **standard form**
5. **expanded notation**
6. **rational number**
7. **integer**

Sight Words Activity Page

Write the key words from this unit horizontally in the boxes (more than one copy of each word can be written). Fill in all other boxes with any letters. Exchange page with another student. Find key words and circle.

Sight Words Activity Page

Highlight or circle the words in this word find.

standard form
real number
rational number
expanded notation
whole number
integer
scientific notation

n o b n a a c a e t w h o l e n u m b a c d u a n
a n u t o i r t t t x a l a n g i w n n e i a r u
n h t r l o f o t i t a m c u e t i b o m n l n r
m o d a n b r r n d n a o r x x b d n e b o a r r
i m e r c s e a e o a s t a n d a r d f o f a e a
e f n a n i i r t a i n e n n l r x x f a c b i a
s m e u o d n r n r n t m t e n d f n s t b n f n
o o n t t o i r o b d h e n n u d t i i n t e g m
r h r t r f o c r a t i o n a l n u m b e o g g o
n a b b i l s c i e n t i f i c n o t a t i o n a
n o e o n l d a r t i n t e g e r h o b f u r l h
g n s c i e n t i f i c n o t a t a t m i t a n n
s t a n d a r d f o r m i i i r r w m e n o e u h
r n a e o m s r n e a r m p s a r s b l i x i r t
u n r r c o a a i o s t i c n i n a u n h r a o n
e n n n l a n r e x p a n d e d n o t a t i m x r
o n e m b c d n o n n b d t n i e e r r e c r o c
i x n r t a t i e a i i b n d d o r a e o t g b u
i a b u f d r x r a t i o n a l n u m b e r d e d
o t l i n d l t a r u a i n n e r r d d e e n d t
o o u n i a r r e w n r n t g t n i a a e p s a e
m l t i t g s i l i n t r d d i a d e d o r o i h
r e a l n u m b e r r o n e a a l e r n e d c a t
e n o u w h o l e n u m b e r r a h i l a f e c a
r r t e a t n r e o i o b a r e a l n u m b i n n
n n i t i n u h s a u r s t r a n n i o t e o e n
t n e m i d b c r e x p a n d e d n o t a t i o n
c d n e s e p e l e a n t f l r n e e n n t l b n
g n i e o e r e a o x o e u m r m o s e e b d r l
o a n a u d l n c a n u n t t c e f x a f u f n e

Sight Words Activity Page

ANSWER KEY

standard form
real number
rational number
expanded notation
whole number
integer
scientific notation

n o b n a a c a e t w h o l e n u m b a c d u a n
a n u t o i r t t t x a l a n g i w n n e i a r u
n h t r l o f o t i t a m c u e t i b o m n l n r
m o d a n b r r n d n a o r x x b d n e b o a r r
i m e r c s e a e o a s t a n d a r d f o f a e a
e f n a n i i r t a i n e n n l r x x f a c b i a
s m e u o d n r n r n t m t e n d f n s t b n f n
o o n t t o i r o b d h e n n u d t i i n t e g m
r h r t r f o c r a t i o n a l n u m b e o g g o
n a b b i l s c i e n t i f i c n o t a t i o n a
n o e o n l d a r t i n t e g e r h o b f u r l h
g n s c i e n t i f i c n o t a t a t m i t a n n
s t a n d a r d f o r m i i i r r w m e n o e u h
r n a e o m s r n e a r m p s a r s b l i x i r t
u n r r c o a a i o s t i c n i n a u n h r a o n
e n n n l a n r e x p a n d e d n o t a t i m x r
o n e m b c d n o n n b d t n i e e r r e c r o c
i x n r t a t i e a i i b n d d o r a e o t g b u
i a b u f d r x r a t i o n a l n u m b e r d e d
o t l i n d l t a r u a i n n e r r d d e e n d t
o o u n i a r r e w n r n t g t n i a a e p s a e
m l t i t g s i l i n t r d d i a d e d o r o i h
r e a l n u m b e r r o n e a a l e r n e d c a t
e n o u w h o l e n u m b e r r a h i l a f e c a
r r t e a t n r e o i o b a r e a l n u m b i n n
n n i t i n u h s a u r s t r a n n i o t e o e n
t n e m i d b c r e x p a n d e d n o t a t i o n
c d n e s e p e l e a n t f l r n e e n n t l b n
g n i e o e r e a o x o e u m r m o s e e b d r l
o a n a u d l n c a n u n t t c e f x a f u f n e

STUDENT SUPPORT MATERIALS

Reading • Encoding

Encoding Activity Page

Have the students cut out the word parts and glue them into their correct words.

real n_____er

w_____ number

scien_____ notation

sta_____ form

ex_____ed notation

ndard	atio	hole
tific	pand	

Encoding Activity Page

r_____nal number

in_____r

tege **umb**

Encoding Activity Page

Have the students cut out the word halves and glue them together to create the key words for this unit.

real nu	tific notation
wh	tation
scien	al number
sta	mber
expanded no	ole number

Encoding Activity Page

ration	**ndard form**
in	**teger**

Encoding Activity Page

Cut out and encode the syllables of the words OR number the syllables in their correct sequence.

ber **num** **real**

_____ _____ _____

whole **ber** **num**

_____ _____ _____

dard **stan** **form**

_____ _____ _____

Encoding Activity Page

sci	en	fic
_____	_____	_____

ta	ti	no	tion
_____	_____	_____	_____

tion	pan	ta
_____	_____	_____

ded	ex	no
_____	_____	_____

Encoding Activity Page

ber	num	tio
_____	_____	_____

ra	nal
_____	_____

Alphabet Page Letter Encode

a b c d e f

g h i j k l

m n o p q r

s t u v w x

y z

STUDENT SUPPORT MATERIALS

Reading Comprehension

What's the Answer?

Read the text and then select the correct answer for it. Fill in the bullet beside the answer of your choice.

1. A rational number or the limit of a sequence of rational numbers is a
   - ❍ Falsehood
   - ❍ Complex Number
   - ❍ Real Number
   - ❍ Infinite Number

2. A _____ doesn't contain a fraction and is an integer which has one or more unit and can be positive or negative.
   - ❍ Whole Number
   - ❍ Triangle
   - ❍ Standard Form
   - ❍ Rate

3. Scientific Notation is written using a number between 1 and 10 and the appropriate power of:
   - ❍ One
   - ❍ Ten
   - ❍ Hundred
   - ❍ Thousand

4. Which of the following is the standard form of a line?
   - ❍ Ax+By=C
   - ❍ Ax-By=C
   - ❍ Ax+B=C
   - ❍ B=C

5. _____ notation shows the place value by multiplying each digit in a number by the appropriate power of 10.
   - ❍ Logical
   - ❍ Illogical
   - ❍ Rational
   - ❍ Expanded

What's the Answer?

6 A rational number is one that can be written in the form a/b where a and b are integers and:

- ❍ b>0
- ❍ b<0
- ❍ b=0
- ❍ b≠0

7 An integer is a _____ number that is not a fraction.

- ❍ Random
- ❍ Whole
- ❍ Continuous
- ❍ Negative

What's the Answer?

ANSWER KEY

1. A rational number or the limit of a sequence of rational numbers is a
   - ❍ Falsehood
   - ❍ Complex Number
   - ● Real Number
   - ❍ Infinite Number

2. A _____ doesn't contain a fraction and is an integer which has one or more unit and can be positive or negative.
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   - ❍ Rate

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   - ❍ Ax-By=C
   - ❍ Ax+B=C
   - ❍ B=C

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   - ❍ Illogical
   - ❍ Rational
   - ● Expanded

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- ❍ b>0
- ❍ b<0
- ❍ b=0
- ● b≠0

7 An integer is a _____ number that is not a fraction.

- ❍ Random
- ● Whole
- ❍ Continuous
- ❍ Negative

Reading Comprehension Activity Page

Write the numbers/letters for sentence halves that match.

1	Real numbers are rational numbers or	A	contain a fraction.
2	A whole number doesn't	B	standard form of a line.
3	Large numbers can sometime be easier to	C	number by the power of 10.
4	Ax + By = C is the	D	whole number that does not contain a fraction.
5	Expanded notation multiplies each digit in a	E	the limit of a sequence of rational numbers.
6	A rational number is any number that can be written as	F	a/b where a & b are integers and b ≠ 0.
7	An integer is a	G	read in scientific notation.

1→_____ 2→ _____ 3→ _____ 4→ _____

5→ _____ 6→ _____ 7→ _____

Reading Comprehension Activity Page

ANSWER KEY

1	Real numbers are rational numbers or	A	contain a fraction.
2	A whole number doesn't	B	standard form of a line.
3	Large numbers can sometime be easier to	C	number by the power of 10.
4	Ax + By = C is the	D	whole number that does not contain a fraction.
5	Expanded notation multiplies each digit in a	E	the limit of a sequence of rational numbers.
6	A rational number is any number that can be written as	F	a/b where a & b are integers and b ≠ 0.
7	An integer is a	G	read in scientific notation.

1→ E 2→ A 3→ G 4→ B

5→ C 6→ F 7→ D

Reading Comprehension Activity Page

Cut out the words and glue them under their definitions.

Written as a/b where a and b are integers and b≠0	**Longer version of a given number**	**A whole number that is not a fraction**
An integer with no fractions	**Rational number or limit of sequence of rational numbers**	**Ax+By=C**
Shortened version of a large number		

real number **whole number** **scientific notation** **standard form**

expanded notation **rational number** **integer**

Reading Comprehension Activity Page

ANSWER KEY

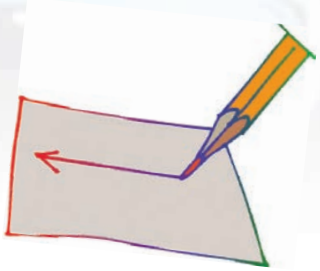
Written as a/b where a and b are integers and b≠0 rational number	**Longer version of a given number** expanded notation	**A whole number that is not a fraction** integer
An integer with no fractions whole number	**Rational number or limit of sequence of rational numbers** real number	**Ax+By=C** standard form
Shortened version of a large number scientific notation		

STUDENT SUPPORT MATERIALS

Writing

Writing Activity Page

Have the students complete the writing of the key math words.



re_____ nu_____r

who_____ num_____

scien_____ not_____n

stan_____ fo_____

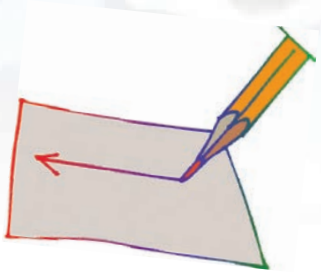
expan_____ no_____ion

rat_____ numb___r

int_____r

Writing Activity Page

Have the students complete the writing of the key math words.



r_____ n_____r

w_____ n_____r

s_____ n_____n

s_____ f_____m

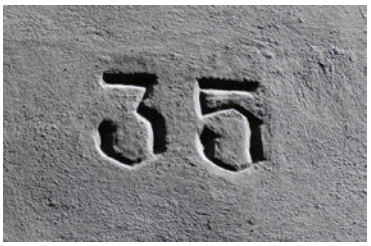
e_____ n_____n

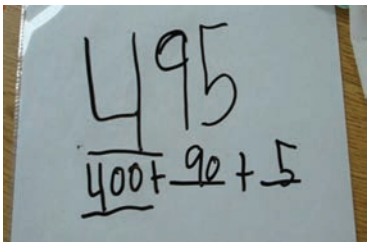
r_____ n_____r

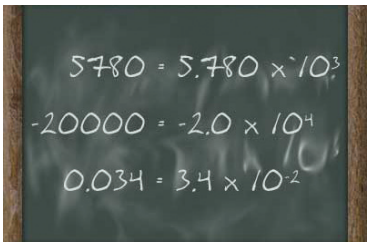
i_____r

Basic Writing Activity Page

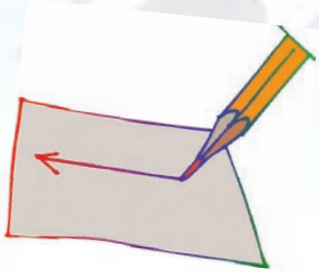
Have the students write the word for each picture.

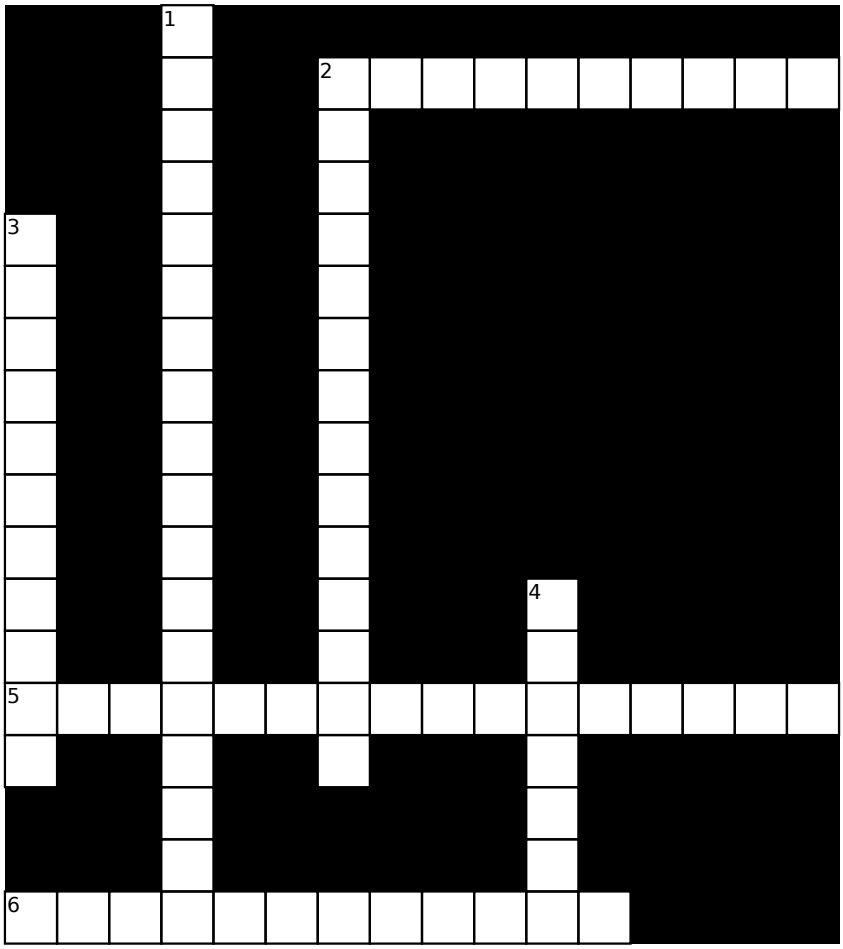






Crossword Puzzle





Across

2 Rational number or limit of sequence of rational numbers (2 Words)

5 Longer version of a given number (2 Words)

6 Ax+By=C (2 Words)

Down

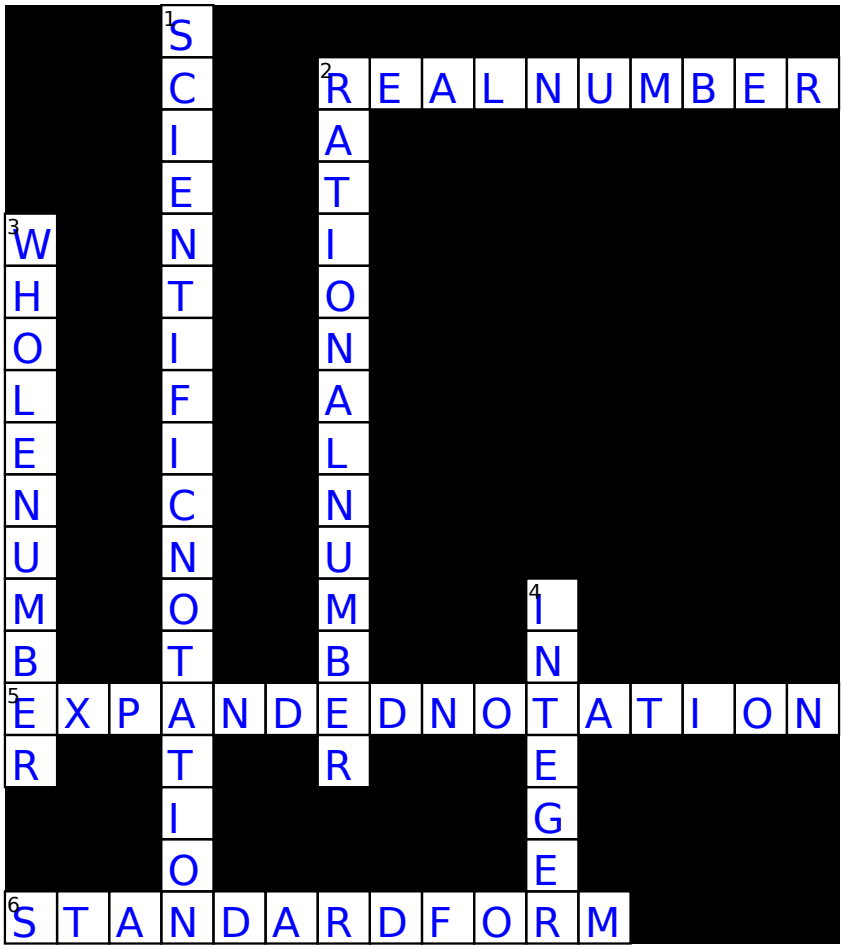
1 Shortened version of a large number (2 Words)

2 Written as a/b where a and b are integers and b≠0 (2 Words)

3 An integer with no fractions (2 Words)

4 A whole number that is not a fraction

Crossword Puzzle Answers



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UNIT ASSESSMENT

Understanding Numbers

Unit Assessment Teacher's Notes
Grade 8 • Unit 1

Date:_____

Unit Assessment

Provide each student with a copy of the students' pages. Read the following instructions aloud. The students should answer the questions on their copies of the assessment.

BASIC LISTENING

Turn to page 1 in your test. Look at the pictures in the boxes.

1. Write the number 1 by the picture for **REAL NUMBER**.
2. Write the number 2 by the picture for **WHOLE NUMBER**.
3. Write the number 3 by the picture for **SCIENTIFIC NOTATION**.
4. Write the number 4 by the picture for **STANDARD FORM**.
5. Write the number 5 by the picture for **EXPANDED NOTATION**.
6. Write the number 6 by the picture for **RATIONAL NUMBER**.
7. Write the number 7 by the picture for **INTEGER**.

SIGHT RECOGNITION

Turn to page 2 in your test. Look at the pictures in the boxes. Circle the word for each picture.

DECODING/ENCODING

Turn to page 3 in your test. Look at the word parts in the boxes. Circle the other half or part of each word.

READING COMPREHENSION

Turn to page 4 in your test. Write each word under its definition.
Refer to Student Support Materials for answer key.

BASIC WRITING

Turn to page 5 in your test. Look at the pictures in the boxes. Write the word for each picture.

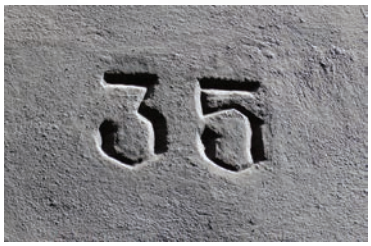
Teacher: To get a percentage for this student's assessment, divide the total number of questions correct by the total number of questions, then multiply this answer by 100 to determine the percentage of questions answered correctly.

MATH PROGRAM

Unit Assessment Student Pages
Grade 8 • Unit 1

Date:_____ Student's Name:_____

Number Correct:_____ Percent Correct:_____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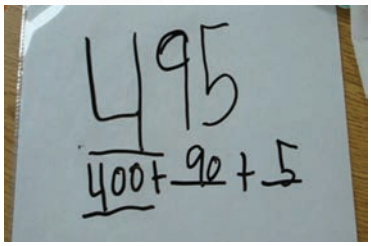
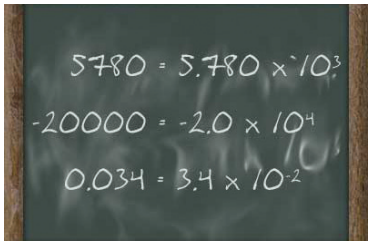
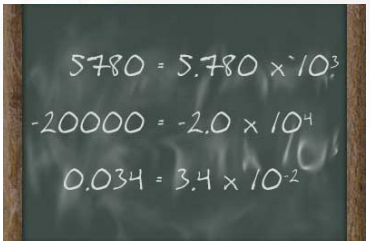

495
400+90+5

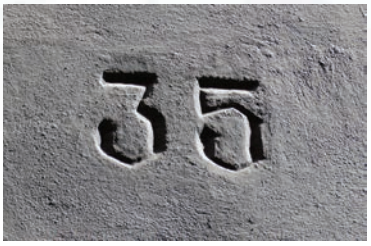
1/4
1/2


5780 = 5.780 x 10^3
-20000 = -2.0 x 10^4
0.034 = 3.4 x 10^-2

Ax + By = C



real number
whole number
scientific notation
standard form
expanded notation
rational number
integer



real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

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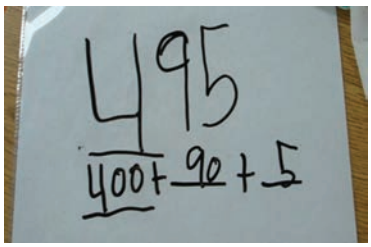
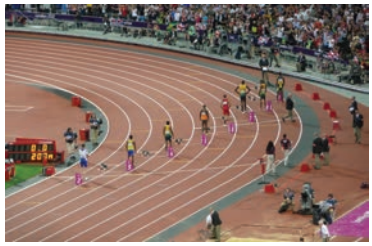


real number
whole number
scientific notation
standard form
expanded notation
rational number
integer



real number
whole number
scientific notation
standard form
expanded notation
rational number
integer

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egir
egor

Written as a/b where a and b are integers and b≠0	A whole number that is not a fraction	Longer version of a given number
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An integer with no fractions		

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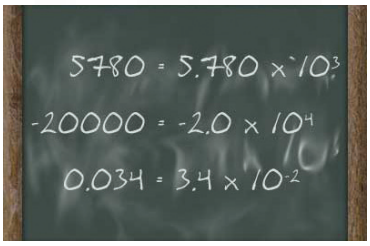
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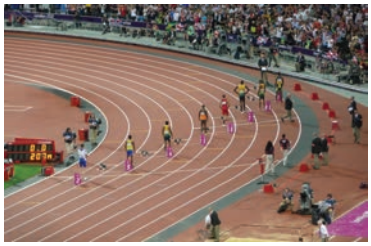
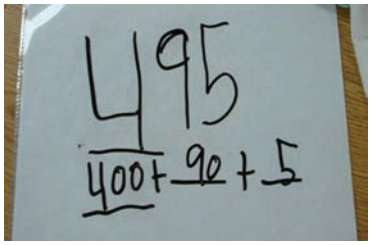
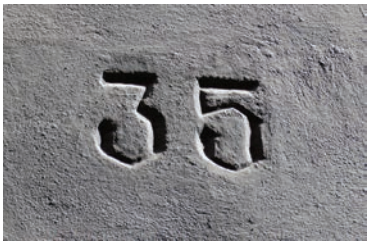



495
400+90+5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